

A Framework for Change Management in Business Process Modeling

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Abstract. With the growing competition in the markets, the business processes of an organization must make necessary adjustments according to the new requirements. In other words, Changes in business processes as a key component of any organization, along with the success of the organization and aligned with the business environment and customer needs, seems inevitable. What is important is the ability to change and verify the accuracy of the process, before it is executed. In this research, we propose a framework for applying the changes and verify these, based on the business process methodology and the integration between UML2.0 activity diagram as a standard technique for business processes modeling and colored petri net as an executable model.

Keywords: change management in business process modeling, UML2.0 activity diagram, colored petri net.

1. Introduction

In a business environment changes are a phenomenon that happens every day, and finally affects business processes in design time or run-time. These changes can have several causes such as errors in the initial design, occurred exceptions, changes in goals and customer needs, technological innovation, inefficient relationships between organizational units and many other reasons [1]. In any case, we must make sure about validation of process in design time and also after applying the change in run-time. Since there is no possibility of analysis and study of business process directly, first they must be modelled. In this research, we have used UML2.0 activity diagram for the initial modeling. Unified Modeling Language(UML) is used as a standard in business process modeling, because of the ability to display different aspects of a process. Some advantages of UML2.0 include extensibility, versatility and high standards. But, UML2.0 has some defects as well, for example, does not support the powerful simulation and analysis techniques, also the process can not be studied before being executed. One solution is to transform it into an executable model as Colored Petri Net(CPN). Using CPN, we can validate business processes before its execution and can validate changes in business processes. Consequently, the changes can be imposed. This is a solution which can use change management to reduce risks and costs and benefits of major changes in business processes.

According to the mentioned reasons, in this paper we want to propose a framework based on integration between UML2.0 activity diagram and CPN to support changes in business processes models in run-time. The paper is structured as follows:

In Section 2, we will review research on this subject. Section 3, explains the structure of proposed framework in this paper concerned with different aspects of the change which we considered. In section 4, we have a comparison between the proposed framework and the framework presented in [2]. Finally, conclusions and suggestions for future work are in section 5.

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2. Literature Review

Transformation of UML Activity Diagram into Colored Petri Net is a subject which is discussed in papers. One solution is to transform UML Activity Diagram into a conceptual model of the petri net which is transformative to a colored petri net for the execution and evaluation. In [3] has been allocated to the basic modeling of the petri net and colored petri net conceptual diagrams. Also, [4] is about the variability modeling in business process models using UML. In this paper, variability modeling using UML2.0 activity diagrams for business process modeling is described and solutions have been proposed to model and classify it based on the variability in business processes.

Other item that shows the importance of this paper is, why UML2.0 activity diagram is selected for the business process modeling. Activity diagrams are suitable to model web processing, web service composition [5], business process modeling, workflow management systems, system integration and even basic software operation. In [6], the suitability of UML2.0 activity diagram for business process modeling has been investigated and using the workflow patterns as an evaluation framework has been tested.

Flexible modeling and execution of workflow activities model suggested by [7] is based on the activity meta-model. The system supports the functionalities of flexibility, and dynamic changes such as add and delete activities but no activity can be in state running during the change time.

The integration between object oriented design and colored petri net is an approach that used in [2] to verify the designed system. The approach integrates OO techniques at the design level and use of CPNs at the verification and validation level. The framework that provided for change management in business processes in [2], supports corrective and evolutionary changes in the process modeling. But, in this framework, is not considered a mechanism for reversibility and correcting errors in process in design-time.

In this paper, we propose a framework based on business process methodology using colored petri net for change management in business process modeling. In this framework that supports corrective changes and processes re-engineering, there is a possibility to verify business process at design-time and run-time. Also, the database is intended to track changes, which maintains the changes in process according to various aspects of change.

3. Proposed Framework

In this section, a framework based on CPN for change management technique in business process modeling is presented, Fig.1. This framework is based on business process methodology (the methodology is described in [8]) and follows the goals below:

Integration between UML2.0 activity diagram and colored petri net modeling for supporting static and dynamic changes in processes.

Checking the validity of modeling by transforming it into a colored petri net and using simulation technique.

Reducing costs due to errors in modeling after execution of business process.

3.1. Design-Time development

According to Fig.1 the steps of the design time in framework are:

Step1) Process Identification. This stage is consistent with survey phase in business process methodology.

Step2) UML2.0 Activity Diagram Design. This step is consistent with design phase in business process methodology.

Step3) Rule Design. The rule design includes reaction rules that can be added into the process models. According to [9] the rule is a combination of 4 parts: Condition (Expression on the arc in CPN), Action (Expression on the arc in CPN), Rule (Transitions in CPN), and Fact (Reachable variables in CPN).

Step4) Mapping UML2.0 Activity Diagram into Colored Petri Net. In step, UML2.0 Activity Diagram maps into CPN according to mapping rules and transformation algorithm presented in [10].

Step5) Implementation and Test. Implementation and Test phase is required to enhance the business process models with information to make them executable. Using CPN model, we can verify model before its execution, which this work is carried out using CPN Tools. After ensuring the validity of process, a database for recording and maintaining process is used.

In each of the steps listed, it is possible to return to a step behind and also return to the UML2.0 Activity Diagram Design phase, so if there are visible errors or errors caused by mistake in the design phase, it can be controlled in the design phase and before the process execution. This trend is according to the business process methodology.

Step6) Process Execution. In execution phase, business process is deployed in user environment. Because in today's competitive world, dynamic processes are inevitable, it is possible to make changes in processes at run time as well. These changes are entered in the framework as rules.

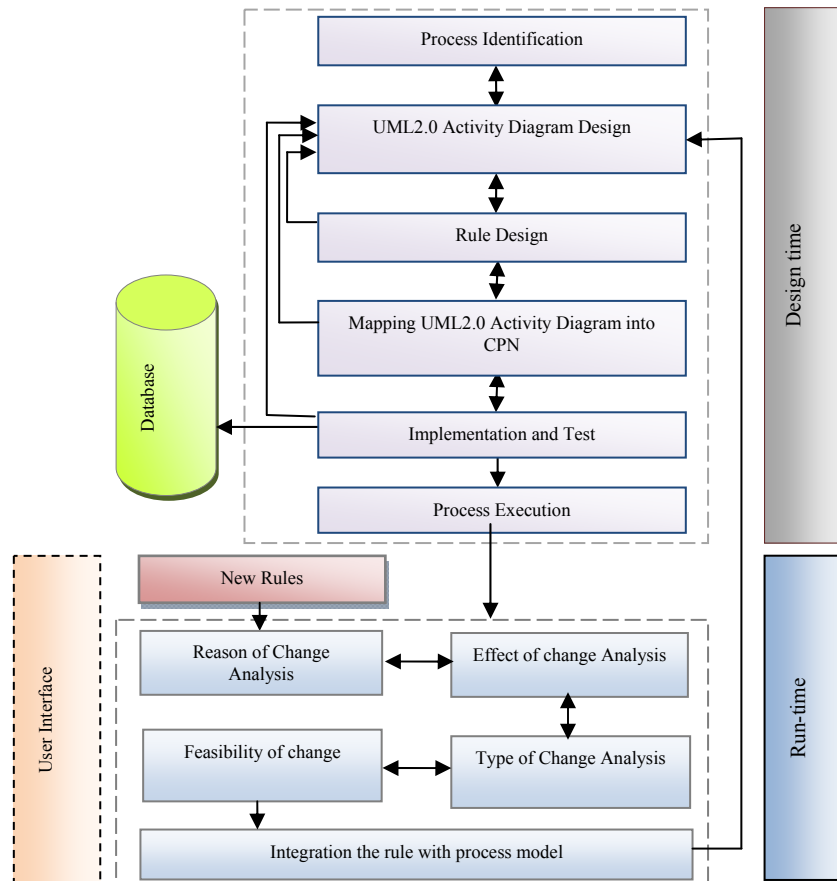


Fig. 1: Structure of Proposed Framework for Change Management in Business Process Modeling

3.2. Different dimensions of change

Formal structure of change management is defined as follows:

Change Management(CM), is a 14- tuple, which varied dimension of change such as reason of change, the effect of change, type of change and the perspectives that are affected by change[11],[12] are seen in it: $CM = (IsC, OsC, CoC, EvC, FuC, BeC, InC, OpC, OrC, ExC, RdC, RpC, RIC, S)$,

Where: IsC and OsC(Inside Changes and Outside Changes), mention to reasons of change. IsCs Change triggered by developments inside the system. OsCs are Changes triggered by developments outside the system, i.e. the context/environment is the primary driver for change.

The effect of change is corrective or evolutionary that Coc and EvC mention these.

Different perspectives of business process[11], which can be affected by the change are: Functional Perspective(FuC), Behavioral Perspective(BeC), Informational Perspective(InC), Operational Perspective(OpC) and Organizational Perspective(OrC). (However, Additional perspectives may be needed for business processes in special environments.).

A change is of type extend(ExC) if new entities are introduced. A change is of type reduce(RdC) if parts are deleted. Changes of type replace(RpC) are a mixture of reducing and extending a specific part. A change is of type re-link(RIC) if there are no entities added or deleted but merely rearranged.

Status(S), used to determine the status of the process, i.e. whether it is active or not. After ensuring the validity of the process, the value of S is according to algorithm.1.

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If new rule creates new process then
    Active S for this process
Else if new rule modifies process then
    Active S for this new processe and inactive S for the old process
Else if new rule deletes a process then
    If S is not active then
        No change S value
    Else wait until the process is closed and then
        Not active S for this process
Else "this type of change is not supported by the framework."
Algorithm.1. Determine the status of the process
    
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3.3. Run-Time development

Each of run-time development phases is described below:

Step1) Reason of Change Analysis. This case will be recorded in a database to track.

Step2) Effect of change Analysis. (CoC or EvC in change management structure). Also, effect of change in Functional, Behavioural, Informational, Operational and Organizational Perspectives is determined.(they will be FuC, BeC, InC, OpC and OrC in change management structure respectively).

Step3) Type of Change Analysis. (ExC, RdC, RpC and RIC in change management structure). These cases will be recorded in a database to track. The three steps listed are recursive.

Step4) Feasibility of change. This step is checking the feasibility of the change: it will be checked based on the rule design in the design time development, also according to the effect of change analysis and type of changes the framework will support.

Step5) Integration the rule with process model. If the framework supports new rule as a change in process, change applied to the activity diagram and other steps are repeated according to the design-time. eventually if the accuracy of changed process is confirmed ,the executed changed process status algorithm and the status of process will be identified. If while making changes a process instance is executed and causes change ,the change will be transferred to the process instance accurately.

For Analysis and Evaluation of the framework, a case study has been used and by interactive simulation provided in CPN Tool, the validity of the proposed framework is examined.

4. Comparison

In this section, we have compared the proposed framework in this research with the framework in [2].

Table. 1: Comparison between this framework with proposed framework in [2]

	<i>Proposed Framework in [2]</i>	<i>Proposed Framework in this Paper</i>
<i>Scientific support</i>	not mentioned	Based on business process methodology in [8]
<i>Ability to return and refine the process in design-time and run-time</i>	have not	Have
<i>Contemplating a database for recording the changes</i>	have not	Have
<i>Tracking changes in various dimensions</i>	have not	Have
<i>Ensuring the validity of the process in design-time and run-time</i>	have	Have

5. Conclusion and Recommendations

As today's business world is so dynamic, in this paper we proposed a framework for change management in business process modeling based on business process methodology and integration between UML2.0 activity diagram and colored petri net. The advantages of the proposed framework are: This framework supports corrective and evolutionary changes. such as business process methodology, this framework has iterative and incremental trend, so the process can be corrected before it is implemented. Using simulation, verification and validation techniques in CPN Tools, the validity of the process in design-time and run-time can be ensured and possible changes can be applied correctly. This framework is independent from initial methodology of modeling and can continue by mapping initial model into an executable model.

In the future an algorithm can be presented to transfer all business modeling techniques to an executable model such as CPN which provides the possibility of verification and analysis also simulate a system based on suggested framework.

6. References

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